



NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594



PIPELINE ACCIDENT REPORT

MUNICIPAL GAS DEPARTMENT OF CORDELE, GEORGIA
EXPLOSION AND FIRE
CORDELE, GEORGIA
FEBRUARY 21, 1980



NTSB-PAR-80-5

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16. Abstract At 11:10 a.m., e.s.t., on February 21, 1980, an explosion and fire destroyed four stores in a shopping complex, severely damaged an adjoining restaurant, and damaged eight cars in Cordele, Georgia. Gas leaking from a 1-inch service line at 22 psig pressure migrated under a concrete block wall, into a service line trench, under a concrete slab floor, and into a jewelry store where it was ignited by an unknown source. Of the eight persons who were injured, three died later as a result of injuries received in the accident. Buildings and nearby automobiles were damaged extensively; no estimate of the dollar loss was made. The National Transportation Safety Board determines that the probable cause of the accident was the snagging, 3 days before, of a 1-inch steel, gas service line by a backhoe which broke the service line in a threaded connection and also pulled it out of an underground compression coupling 14 feet away. Contributing to the accident were: (1) the failure of the Cordele municipal gas department personnel to check for additional damage to the service line or to conduct a gas leak survey after snagging the line, and (2) the failure of the gas department to inject adequate amounts of gas odorant daily in the gas distribution system to facilitate detection of escaping gas.			
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**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594**

PIPELINE ACCIDENT REPORT

Adopted: September 9, 1980

**MUNICIPAL GAS DEPARTMENT OF CORDELE, GEORGIA
EXPLOSION AND FIRE
CORDELE, GEORGIA
FEBRUARY 21, 1980**

SYNOPSIS

At 11:10 a.m., e.s.t., on February 21, 1980, an explosion and fire destroyed four stores in a shopping complex, severely damaged an adjoining restaurant, and damaged eight cars in Cordele, Georgia. Gas leaking from a 1-inch service line at 22 psig pressure migrated under a concrete block wall, into a service line trench, under a concrete slab floor, and into a jewelry store where it was ignited by an unknown source. Of the eight persons who were injured, three died later as a result of injuries received in the accident. Buildings and nearby automobiles were damaged extensively; no estimate of the dollar loss was made.

The National Transportation Safety Board determines that the probable cause of the accident was the snagging, 3 days before, of a 1-inch steel, gas service line by a backhoe which broke the service line in a threaded connection and also pulled it out of an underground compression coupling 14 feet away. Contributing to the accident were: (1) the failure of the Cordele municipal gas department personnel to check for additional damage to the service line or to conduct a gas leak survey after snagging the line, and (2) the failure of the gas department to inject adequate amounts of gas odorant daily in the gas distribution system to facilitate detection of escaping gas.

INVESTIGATION

The Accident

At 8:30 a.m., 1/ e.s.t., on February 18, 1980, a Cordele, Georgia, municipal gas department crew discontinued service and removed the gas meter from a gasoline service station that was being torn down. The gas crew excavated, cut, and capped the branch service line at a point approximately 40 feet away from the service. The crew used a pipe locator 2/ to locate the service line, and a backhoe

1/ All times herein are eastern standard, based on the 24-hour clock.

2/ An electronic signaling instrument that locates underground metallic objects.

and shovels to dig for it. While digging for the service line, the backhoe snagged and broke it at a threaded coupling and pulled it laterally more than 12 inches out of line. The crew removed the remains of the threaded coupling, installed a 1-inch threaded cutoff valve, closed the valve and put a plug in the open end, backfilled the excavation, and left the scene. No further excavation was done to check for possible additional line damage and no gas leak survey was conducted to check for escaping gas.

On February 21, 1980, about 11:00 a.m., as a jewelry store employee and a friend were entering the store, an explosion knocked both persons to the ground. The jewelry store employee said he believed three explosions occurred in rapid succession, although the other person said he was only aware of two explosions. Both witnesses testified that during one of the explosions, plate glass windows, doors, and two jewelry store customers were blown out of the store. After he recovered, the jewelry store employee entered the store to assist the store manager in evacuating the building. At that time, he noticed fire on the northwest wall of the jewelry store. (See figure 1.)

After the other witness recovered, he went to the parking lot to assist the injured customers and to smother their burning clothes. He said that the first explosion occurred somewhere in the northwest corner of the jewelry store, while the second explosion seemed to occur in the center of the building. A paint store, gift shops, a barber shop, a clothing store, and insurance agencies were also located in the shopping complex. Each business was joined by a common wall except the supermarket and a furniture store which were in separate buildings. (See figures 2 and 3.)

The Cordele Fire Department, which had been called by the furniture store owner at 11:14 a.m., arrived on the scene about 4 minutes later. They found four stores engulfed in flames and fire burning along the top row of the 8-foot concrete block retaining wall located approximately 4 feet west of the destroyed stores. (See figure 1.)

All injured persons had been removed from the rubble by private citizens in the area before the fire department arrived. The fire department immediately started to contain the heavy fire that followed the explosion.

Shortly after the accident, a supermarket employee was advised by an unidentified person to close the supermarket located on the east side of the parking lot at East 16th Avenue because of gas leakage that was seeping from the shopping complex. The supermarket employee stated that the store was closed for approximately 2 hours and that the electricity was shut off for about 7 minutes. He complained about the odor of smoke but he did not mention the odor of gas. No indication of leaking gas was detected at this location.

The Cordele operations superintendent arrived on the scene about 11:36 a.m. and was advised by the police that an automobile had exploded. He said that he did not detect any gas odor although he observed flames burning on top of the concrete block retaining wall west of the shopping complex. When the gas department crew foreman arrived at the accident site immediately after the operations

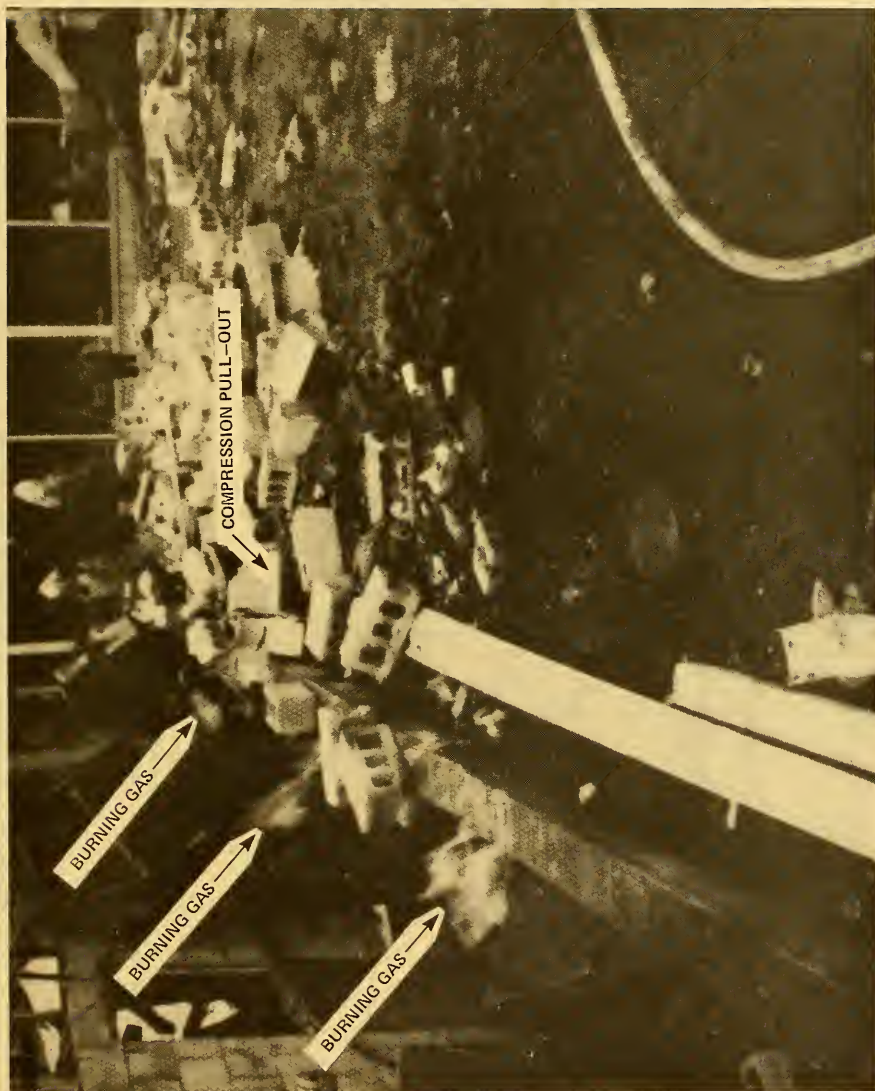


Figure 1.--Gas burning along top of retainer wall.

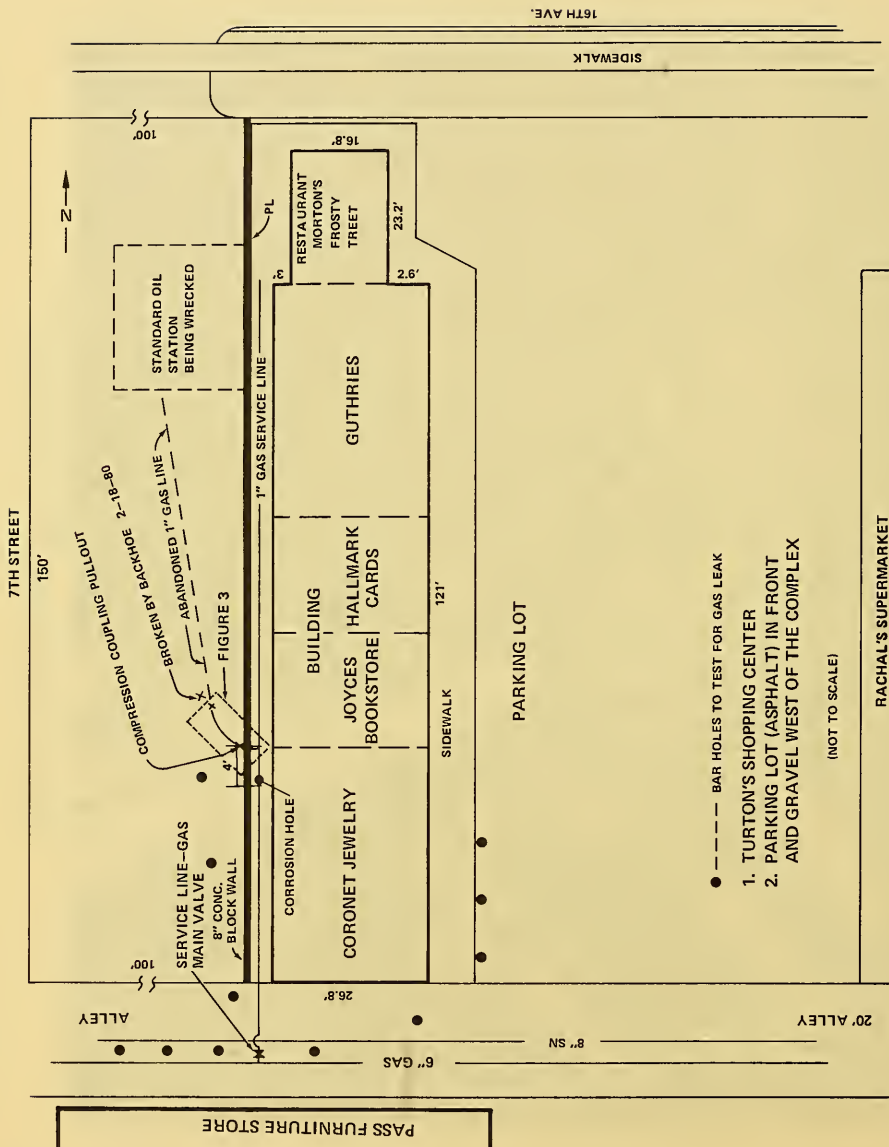


Figure 2.--Location of buildings on the 6-inch main and service line.

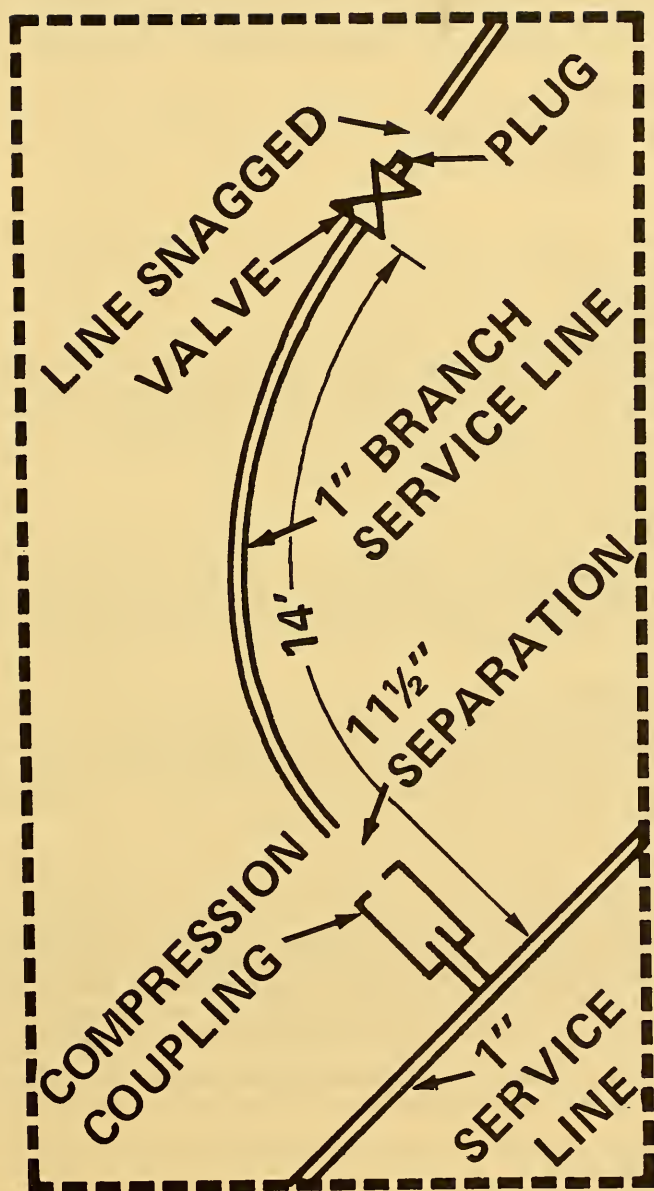


Figure 3.--Location of compression coupling pullout and line separation.

superintendent, he called for additional construction personnel to report onscene to dig down to a valve located on the 1-inch service line where it joined the 6-inch gas main in the alley between 6th and 7th Streets and to turn off the gas to the service line at the main. The gas was turned off about 40 minutes after the explosion and the flames began to diminish noticeably.

Injuries to Persons

<u>Injuries</u>	<u>Operating Personnel</u>	<u>Store Customers</u>	<u>Employees</u>	<u>Total</u>
Fatal	0	2	1	3
Nonfatal	0	4	1	5
Total	0	6	2	8

Damage to Pipeline

After the explosion, gas department personnel uncovered the 1-inch branch service line that had previously served the gasoline station and found that it had been pulled out of a 1-inch steel compression coupling at the connection to the service line and was separated by 11 1/2 inches, approximately 14 feet upstream from the closed valve which had been installed on February 18. Gas had been escaping from the separated line at 22 psig for 3 days.

Other Damage

Four stores (Coronet Jewelry, Joyce's Bookstore, Hallmark Cards, and Guthries) and their contents were destroyed by the explosion and the ensuing fire. In addition, an adjoining restaurant (Morton's Frosty Treet) was severely damaged. Eight cars, located on the shopping complex parking lot, were damaged.

Personnel Information

The backhoe operator began working for the gas department on the morning of February 18, 1980. He had little gas maintenance or repair experience, but he had operated backhoes "... on and off for 15 to 20 years. ..." The foreman had been employed by the gas department for 24 years.

Pipeline System

The Cordele gas distribution system is owned and operated by the city of Cordele, Georgia. The system was completed and placed into operation in 1956 with fewer than 600 customers. The gas department's annual report for 1979 indicated that Cordele had 2,806 residential gas customers and 11 commercial customers. The Cordele gas distribution system is one of approximately 960 municipal publicly-owned gas distribution systems in the United States. ^{3/}

The gas distribution system in the area of the accident consisted of a 6-inch coated and wrapped steel main, operating at 22 psig pressure, which ran through an

^{3/} Directory of municipal national gas systems ninth edition 1979, American Public Gas Association.

alley east from 7th Street East to 6th Street and beyond. The 1-inch service line extended north from the 6-inch gas main from a point 100 feet east of 7th Street. (See figures 2 and 3.) The 1-inch branch service line was connected to the service line about 50 feet north of the main.

Meteorological Information

At the time of the accident, the temperature was in the mid-60's, with winds from the southwest at 8 to 10 kns. It had not rained during the week before the explosion.

Fire

The accumulation of gas which migrated through the concrete blocks forming the west wall of the shopping complex continued to burn after the explosion for about 2 hours. The fire on top of the 8-foot retaining wall 4 feet west of the west wall of the jewelry store was repeatedly ignited by the still-smouldering debris each time the fire department extinguished it; it was finally extinguished after the gas was turned off at the gas main-service line connection valve. The fire in the destroyed buildings was extinguished about 1:30 p.m.; however, the fire department remained onscene until about 4:15 p.m. (See figure 4.)

Survival Aspects

When the explosion occurred, two customers and the jewelry store manager were inside near the front of the store. The customers were blown through the plate glass doors into the parking area. The manager remained inside until she was assisted from the accident area by the employee who had arrived on the site moments before the explosion. The two customers and the manager were transferred to burn centers the night of February 21, 1980; however, all three died later.

The owner of a bookstore and a customer in a card shop were burned. They were transported to local hospitals, where they were admitted in serious condition. Three others, who were injured but not seriously, were treated and released.

Tests and Research

Personnel from the Cordele gas department excavated and exposed approximately 40 feet of the bare 1-inch service line that had served the four demolished buildings and the damaged restaurant. The 1-inch gas line was located between the retaining wall and the cinder block storewalls, and was directly under and ran parallel with a 4-inch cast iron sewerline; the gas line was separated from the sewerline by concrete blocks. (See figure 5.) The separation between the gas line and the sewerline started at the 6-inch steel main and was approximately 9 inches. As the lines continued to run north and behind the affected building, the separation increased to approximately 24 inches.

When the 1-inch steel line was removed from the trench, a corrosion hole, approximately 0.093 of an inch, was found in the line. (See figure 6.) A visual



Figure 4.--View of internal damage of destroyed buildings.

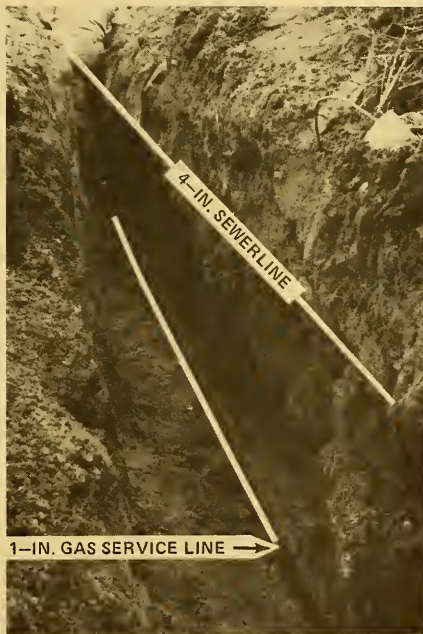


Figure 5.--One-inch line in trench under 4-inch sewerline.



Figure 6.--Corrosion hole in 1-inch steel line.

inspection of the hole indicated that the corrosion was not recently active because the metal around the hole had rusted and was not bright. (Bright metal surrounding a corrosion hole indicates an active corrosion condition.)

After the accident, a gas leak survey was conducted using combustible gas indicators (CGI's). The survey revealed heavy concentrations of gas in the bar holes inserted around the south end of the shopping complex, in the parking areas, and around the 6-inch gas main adjacent to the jewelry store. High level gas readings in the bar holes used by investigators to locate the leaking gas revealed that the most likely location of the leak was 3 to 4 feet west of the retaining wall where the gas had been burning, and approximately 40 feet north of the south building line of the shopping complex. (See figures 2 and 3.)

Other Information

Supervision of Gas System.--The city of Cordele, Georgia, has a city manager and a five-member commissioner form of government; there is no mayor. The five commissioners are elected for 5-year terms with one commissioner's term expiring each year. A chairperson is elected each year by the five commissioners to serve for 1 year.

The commission establishes policies, rates, and charges for city operations and delegates specific authorities to the city manager. The city manager directs and provides general supervision to operations of the gas system through the city's operations superintendent, who has three permanently assigned personnel (a foreman, one laborer, and a backhoe operator) to operate the city's gas system.

Gas Odorant Level.--The Cordele operations superintendent stated that he did not smell any odorized natural gas when he arrived at the accident site, and that no gas leak complaints had been received by the gas department before the accident. The jewelry store employee said that he had not smelled any gas odors and; furthermore, that he was not aware of any public education program initiated by the city of Cordele explaining the characteristics of natural gas and what to do in case odor was detected. The city manager and the superintendent stated that Cordele had not yet established a gas education program.

The gas department records showed that 195 gallons of odorant had been injected into the gas distribution system between March and November 1979. Records showing the daily average odorant level were not maintained as required by 49 CFR 192.625, Odorization of Gas, and no tests had been conducted by Cordele to determine whether the odorization equipment had been injecting the odorant uniformly and within the prescribed limits, i.e., odorized so that at a concentration in the air of one-fifth of the lower explosive limit, the gas was readily detectable by a person with a normal sense of smell. The volume of gas through this system during the period March 1979 until February 1980, when another batch of odorant was injected, amounted to 308,303 MCF (million cubic feet). (See appendix A.) The Safety Board was unable to determine whether the last batch of odorant had been injected before or after the accident. A Cordele gas department service man stated that on two occasions during the week of February 17, 1980, he had smelled gas odors while setting meters; however, the

odor was not as strong as he smelled after refilling the odorizer tank. Chapter V of the "Operation Manual Including Inspection and Maintenance Plans" for the city of Cordele gas department, reads in part:

General

Records should be maintained on all new construction and repairs or changes to existing facilities in sufficient detail to provide historical information, location, and other data pertinent and necessary for safe operation and maintenance of the system. Records shall include the following:

* * *

7. Odorization records including average daily injection rate and tests conducted to determine effectiveness.

The city of Cordele had not recorded the average daily injection rates nor conducted odorant effectiveness tests.

Gas Leak Survey.—A gas leak survey of the gas mains in the downtown area of Cordele was completed by an independent contractor in December 1979. The city manager advised the Safety Board's accident investigator that gas department personnel conducted walking leak surveys of the downtown services on a yearly basis; however, the general leak survey records did not reveal a walking survey of any service lines. In addition, the city did not have any maps showing the location of the service lines to aid gas crew personnel in conducting accurate leak surveys.

Notification of Accident.—The city of Cordele reported the accident to the National Response Center (NRC) at 4:30 p.m., on February 21, 1970. The Safety Board was initially notified of the accident at 4:35 p.m., on February 21, 1980.

Federal Regulations.—The following Federal regulations are pertinent to this accident:

1. Title 49 CFR 191.5, which requires immediate telephonic reporting of pipeline leaks.
2. Title 49 CFR 192.615(d), which requires the establishment of a continuing education program to enable customers, the public, and others to recognize gas pipeline emergencies and to report them to appropriate officials.
3. Title 49 CFR 192.625(e), which prohibits operating a system without checking odorization equipment for uniform odorization injection levels.
4. Title 49 CFR 192.703(b)(c), which prohibits the operation of an unsafe segment of pipeline without having promptly repaired, replaced, or removed it from service.

As a result of its own investigation after this accident, the Southern Region Office of the Operations and Enforcement of the Materials Transportation Bureau issued a Notice of Probable Violation and Proposed Civil Penalty to the city of Cordele.

ANALYSIS

Events Preceding the Accident

When the gas crew arrived at the gasoline service station site to discontinue the service and remove the gas meter, they did not have any maps to locate the branch service line that serviced the meter. An electronic pipe locator is usually accurate for detecting the lateral location of a pipe, but it is not useful for determining the depth of the pipe. The crew should have located the service line by hand excavation first and then used the backhoe to enlarge the hole sufficiently to cut and cap the line.

Furthermore, after the 1-inch branch service line had been broken by the backhoe, the crew failed to consider the possibility that the line could have been damaged upstream of the break. When the gas crew saw that the line had been snagged and pulled more than 12 inches out of line, they should have assumed some problems could develop elsewhere and should have checked either by continued excavation or bar hole testing for gas, leaks, or both. The crew was again hampered by the fact that it did not have maps indicating how the branch service line was connected to the other service line serving the four affected buildings. The maps might have alerted the crew to the nearby compression coupling, and they may have checked for leaks near it.

The Accident

No one at the accident site had detected gas odors before the accident. The Cordele operations superintendent did not detect the odor when he arrived at the site, even though he immediately observed the gas burning along the top of the retaining wall. He should have been able to smell properly-odorized gas which had been leaking at 22 psig pressure from the open end of a 1-inch service line for 3 days. In addition, the operations superintendent should have assumed that natural gas was leaking in significant quantity when he saw the flames burning from the top of the concrete blocks.

The Safety Board could not determine the precise amount of odorant that had been injected into the system since the gas department odorant records were incomplete and did not reveal the average daily volume of odorant injected into the system. Gas escaping from a 1-inch diameter service line at 22 psig pressure for 3 days should have been detected if it had been properly odorized; but no gas odor complaints had been received before the explosion.

The Corrosion Hole

The corrosion hole, which was inactive when the line was exposed and inspected, measured approximately 0.093 inch. How long the corrosion hole had been this size could not be determined because stray current on the 1-inch bare service line was not measured before the line was removed from the trench. The 0.093-inch corrosion hole under internal pressure of 22 psig, would leak approximately 0.037 MCF per hour; however, no leaking gas had been detected in the alley by HFIs at this location in November 1979, 3 months before the explosion. In addition, the Safety Board was informed that the leak survey, conducted over the 6-inch gas main in the alley by an independent contractor in November 1979, which would have detected an accumulation of gas from a small leak, did not reveal any leakage. The gas from this small corrosion hole located approximately 40 feet away from the 6-inch gas main had not migrated into the alley and up to the main.

The Safety Board determined that 0.037 MCF of gas per hour leaking into the soil outside the buildings would not have accumulated in sufficient amounts to explode, cause such extensive damage, and continue to burn after the explosion until the gas was shut off at the buried valve. The rapid decrease and final extinguishment of the flames after the valve was closed is compelling proof that the gas leak involved was at the pullout of the service line from its compression coupling; the corrosion hole, although allowing minor gas leakage, was not the cause of this accident.

Notification of Accident

The city of Cordele did not report the accident telephonically to the NRC until 4:30 p.m., on February 21, 1980, over 5 hours after the accident. The Safety Board received the first notification of the accident at 4:35 p.m., on February 21, 1980. Initial telephonic attempts by the Safety Board to verify whether or not a natural gas pipeline was involved met with no positive answer from the city of Cordele. Even though natural gas burning at the accident site was observed by many persons, the Safety Board was initially informed that an automobile had exploded. The Safety Board was not informed until the morning of February 22 that natural gas had been involved. As a result, the Safety Board's accident investigator did not arrive at the accident site until 4:30 p.m., February 22, 1980, 29 hours after the explosion. The late notification and the consequent late arrival of the accident investigator hampered the timely onsite witness interrogation and precluded the visual inspection of the pipe as it was unearthed.

As a result of the late notification of this accident, the Safety Board issued Safety Recommendation P-80-43 on June 4, 1980, to the American Gas Association and the American Public Gas Association.

On January 29, 1971, a letter from the Acting Director, Office of Pipeline Safety (OPSO), Department of Transportation (DOT), to each owner or operator of gas pipeline facilities, stated, in part:

"49 CFR 191.5 requires each operator to give direct telephone notice to the Office of Pipeline Safety at the earliest practicable moment following discovery of certain

types of leaks described therein, and identifies the information to be furnished. In most cases, this telephonic report can and should be made within one to two hours after discovery."

OPSO Advisory Bulletin No. 77-6, June 1977, addressed the fact that some operators had been delinquent in making telephonic notices of reportable leaks to OPSO.

Gas Education Program

Title 49 CFR 192.615, Emergency Plans, requires that:

(d) Each operator shall establish a continuing educational program to enable customers, the public, appropriate government organizations, and persons engaged in excavation-related activities to recognize a gas pipeline emergency for the purpose of reporting it to the operator or the appropriate public officials. The program and the media used must be as comprehensive as necessary to reach all areas in which the operator transports gas. The program must be conducted in English and in other languages commonly understood by a significant number and concentration of the non-English speaking population in the operators area.

However, the city manager and operations superintendent stated that Cordele had not established an educational program to comply with 49 CFR 192.615(d). Furthermore, at the accident site, witnesses stated that they were unfamiliar with the odor of natural gas odorant.

Between 1972 and 1980, the Safety Board investigated 17 pipeline accidents which occurred on municipal gas systems and which caused 25 fatalities and several million dollars in damage. Most of the accident, like this one, could have been prevented by the application of proper practices and procedures and by adherence to the prescribed regulations. (See appendix B.)

CONCLUSIONS

Findings

1. If a map of the branch service line had been available when the service line was excavated, the line might have been located more accurately, and might not have been snagged; the existence of the compression coupling in the vicinity would have been shown, and more consideration might have been given to the possibility of other damage.

2. Excavation damage separated the 1-inch service line, 11 1/2 inches from a compression coupling and gas leaked at 22 psig for 3 days before it was ignited and exploded by an undetermined source.
3. Gas escaping from a 1-inch diameter service line at 22 psig pressure for 3 days should have been detected if it had been properly odorized; but no gas odor complaints had been received before the explosion.
4. The corrosion hole, although allowing minor gas leakage, was not the cause of this accident.
5. The city of Cordele had not established a gas detection educational program as required by 49 CFR 192.615 before the accident.
6. The Cordele gas department was late in notifying the NRC of the accident.
7. The emergency response of the Cordele fire department was excellent.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the snagging, 3 days before, of a 1-inch steel, gas service line by a backhoe which broke the service line in a threaded connection and also pulled it out of an underground compression coupling 14 feet away. Contributing to the accident were: (1) the failure of the Cordele municipal gas department personnel to check for additional damage to the service line or to conduct a gas leak survey after snagging the line, and (2) the failure of the gas department to inject adequate, amounts of gas odorant daily in the gas distribution system to facilitate detection of escaping gas.

RECOMMENDATIONS

During the investigation, the National Transportation Safety Board issued the following safety recommendations:

- to the city of Cordele, Georgia:

Immediately establish gas pipeline system maps and records to include distribution services and maintain accurate measurements to implement the gas systems operating and maintenance plan. (Class II, Priority Action) (P-80-39)

Instruct its gas department crews to specifically locate gas lines by a safe means before excavating. (Class I, Urgent Action) (P-80-40)

Develop and implement odorization monitoring procedures that comply with the requirements of 49 CFR 192.625. (Class II, Priority Action) (P-80-41)

Instruct its gas department employees to make sufficient checks to ensure that all leaks resulting from excavation damage have been located and repaired. (Class I, Urgent Action) (P-80-42)

- to the American Gas Association and the American Public Gas Association:

Notify its member systems of the known particulars of the Cordele, Georgia, accident and advise them to review 49 CFR 191.5, Telephonic Reporting of Leaks, Accidents, and Other Related Failures, to ensure that appropriate instructions have been issued to their employees regarding the reporting requirements. (Class II, Priority Action) (P-80-43)

Advise its member systems to review and modify as necessary their procedures for maintaining odorization records and files in compliance with CFR 192.625, Odorization of Gas, and advise its member systems to review and modify as necessary their maintenance and operation procedures to ensure that all leaks resulting from excavator damage have been located and repaired. (Class II, Priority Action) (P-80-44)

Advise its member systems to review and modify as necessary their procedures for maintaining necessary maps and records to include all distribution services and record accurate measurements to implement the gas systems operation and maintenance plan. (Class II, Priority Action) (P-80-45)

- to the Research and Special Programs Administration of the Department of Transportation:

Inspect the city of Cordele gas system for compliance with applicable Federal regulations and take necessary action. (Class II, Priority Action) (P-80-46)

Expedite rulemaking action on location, size, and operating pressure of pipelines. (Class II, Priority Action) (P-80-47)

The Safety Board has not yet received responses to the recommendations made during the investigation.

As a further result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

- to the Research and Special Programs Administration:

Emphasis to its regional field office personnel the importance of requiring all municipal gas operators within their region to comply with 49 CFR 192.165(d). (Class II, Priority Action) (P-80-71)

Survey a representative sample of similar small-sized, municipally-owned, gas distribution systems serving less than 100,000 customers, which are not required to submit written reports of pipeline accidents, to determine their compliance with pipeline safety regulations and safe operating practices. (Class II, Priority Action) (P-80-72)

- to the city of Cordele, Georgia:

Immediately initiate a program as required by 49 CFR 192.615(d), to enable its customers and the general public to recognize the odor of natural gas and to know the proper action to take when it is detected. (Class I, Urgent Action) (P-80-73)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, did not participate.

September 9, 1980

APPENDIX A

**APPENDIX B
MUNICIPAL PIPELINE ACCIDENTS INVESTIGATED
BY THE SAFETY BOARD**

<u>Municipal</u>	<u>Date</u>	<u>Fatalities/Damage</u>
Sunset, La. - Municipal	06-15-75	1 fatal
Bainbridge, Ga. - Municipal	08-25-75	1 fatal
Brewton, Ala. - Municipal	01-06-76	\$300,000
Phenix City, Ala. - Municipal	03-27-76	6 fatal
Huntsville, Ala. - Municipal	09-29-76	1 fatal
Lewisburg, Tenn. - Municipal	10-31-76	1 fatal
Knoxville, Tenn. - Municipal	01-06-77	1 fatal
Cherokee, Ala. - Municipal	07-30-77	1 fatal
Nebraska City - Municipal	09-01-79	1 fatal
Bamberg, S.C. - Municipal	01-06-79	1 fatal
Hasting, Neb. - Municipal	02-10-79	\$4-5 million
Ft Payne, Ala. - Municipal	11-17-79	1 fatal
Charlottesville, Va. - Municipal	12-17-79	\$1/2 million
Cordele, Ga. - Municipal	02-21-80	3 fatal
Dublin, Ga. - Municipal	05-02-80	3 fatal
Adamsville, Ala. - Municipal	02-07-73	3 fatal
Adamsville, Ala. - Municipal	11-12-72	1 fatal
Total 17		25 fatal

DATE DUE

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- TN 880.5 .U58 80-5
 - Municipal Gas Department of
 - Cordele, Georgia explosion
 - and fire, Cordele, Georgia,
 -

TN 880.5 .U58 80-5
 Municipal Gas Department of
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 and fire, Cordele, Georgia,

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